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ABSTRACT

This paper reports on strategies employed by Australian universities to provide support and encouragement for female students in the area of computing. National objectives were set to improve the balance of women in higher education courses, with an emphasis on research and higher degrees and non-traditional courses for female. A "Women in Computing" group was established to provide a peer to peer network for women in a traditionally male-dominated area. A synopsis of major projects and initiatives undertaken at eight universities to redress the gender imbalance is presented; the projects focus on encouraging females to develop the necessary skills to enroll in computing courses and decreasing female attrition. (Contains 21 references.) (AEF)

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Confronting Issues of Gender in Information Technology in Australia

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Abstract

In February 1992 at the University of Tasmania, the Australasian Women In Computing group began with the hosting of the first Women in Computing Symposium. This and subsequent conferences have provided a forum for women to meet, exchange ideas and present research. One of the foci has been on how we can better promote, support and retain our female students in computing. This paper will report on a number of the strategies employed by various Australian Universities to provide this support and encouragement for female students in the computing discipline.

Background - The need for the Women in Computing Group

Peer to peer networking has been adopted enthusiastically through the 1980's as a way of enhancing business and career options. It has been noted that women have employed this strategy most successfully and case studies of successful women administrators often point to networking as the critical success factor supporting their management style. Sue Curry Jansen (Jansen 1989) has noted that women in western cultures have historically developed their own alternative information networks such as sewing circles and midwifery as well as reconfiguring mainstream information technologies to serve alternative purposes - such as the telephone. Laura Rakow (Rakow 1988) has documented the transition of the telephone from a tool to support

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business to a household necessity - largely due to the adoption of it by women as a means of networking to support their then predominantly house based activities.

The establishment of a Women in Computing group was, to some extent, to provide this peer to peer network. A radical restructuring and rationalisation of tertiary institutions during the 1990's in Australia had produced large, multi-campus, multi-purpose universities. Old networks were destroyed as the participating groups went out of existence. Most of the traditional information systems/computing groups, whether they were academic or professional, had male dominated executives and a male organisational style. The Australasian Women in Computing network has helped bridge the gap. The group has adopted a supportive style based on inclusion and cooperation and has actively guarded against any moves to change it to a more traditional male oriented hierarchical structure and decision making style.

The Australian setting

The participation of women in the world of computing is unequal in Australia as in many parts of the world. Approximately 20% of the business computing workforce are female, and of these only 0.25% of women are information technology professionals who earn $80,000 or more per annum. The number of female students enrolled in undergraduate and postgraduate computing courses in Australian universities is also very low. At the same time the drop out rate of female students doing computing courses is high.

The Commonwealth Government Department of Employment, Education and Training - DEET (1990) listed objectives, targets and strategies to achieve equity in higher education for all groups in society. Women were one of the major target groups. Women's participation in higher education had increased steadily to 52.7% of the student cohort by 1991. However, the concentration of women, remained mainly in the arts/humanities, health and education fields (Office of the Status of Women 1993).

National objectives were set to improve the balance of women in higher education courses. Emphasis was placed on two areas:

1. Research and higher degrees.
2. Non-traditional courses - defined as courses where females have generally been significantly under represented. These included the areas of engineering, business studies, economics and science (DEET 1990)

Targets were established where, by 1995, the proportion of women in engineering would be 15% and in other non-traditional courses would be at least 40%. The numbers of women in postgraduate study was also targeted to rise relative to the percentage of women as undergraduates in each area.

In 1993 the Australian Government issued *The New National Agenda for Women* which outlined objectives for the development and implementation of its strategy for women to the year 2000. The Agenda promoted the importance of education as a means by which women could improve the overall quality of their lives. The Commonwealth Government actively encouraged all higher education institutions to provide appropriate support for women in non-traditional courses (Office of the Status of Women 1993).

Computing is one such 'non-traditional' area. Across Australia there is some variation in enrolments in computing courses, between the states and by institution. In 1990 for example, in computer science/information systems courses, New South Wales had 32% enrolments of females. At the other end of the spectrum was Queensland with a female enrolment of 18% (DEET 1993). In 1991 the nation-wide average was 28% female enrolments in higher education computing courses (Gibson 1993, p22). Statistics from other western countries told a similar story: In the United States 33% of Computer Science degrees were awarded to female students, at the undergraduate level, and 11% at the doctoral level (Frenkel 1990). In Britain the number of female students enrolling in computer science degree courses fell from 25% in 1978 to 10% in 1987 and improved slightly to 13% in 1989 (Lovegrove and Hall 1991).

Redressing the Imbalance

Clayton (1993) argued that to increase female participation in the computing profession, three main stages must be recognised and addressed:

1. *pre tertiary* — *to encourage females to develop the necessary prerequisite skills and to enrol in computing courses*
2. *tertiary* — *to decrease female attrition*
3. *post tertiary* — *to equip females with the necessary skills and contacts to get positions in the profession* *(Clayton 1993, p16)*

Before actively encouraging more females to enrol in computing degrees it is important to ensure that female students will have the same chance of success as their male counterparts. The research projects which will be discussed have focused on the first or second stage as identified by Clayton.

The following is a synopsis of major projects and initiatives undertaken to redress the gender imbalance by some of Australia's 38 Universities. Most of this material was presented at the Women in Computing Conferences from 1991 to 1994. Due to the targets set by DEET many of the projects outlined have been able to secure funding by way of equity grants.

Central Queensland University

At the University of Central Queensland (CQU) a Women in Computing (WIC) committee was formed in 1992 to look at increasing women's successful participation in computing courses at CQU. Information contributed at the first Women in Computing Conference was used as the starting point for the formation of strategies to improve the gender balance in these courses. The WIC group decided to work with both pre tertiary and tertiary level students.

Pre Tertiary:

- A 'Careers in Computing Information Pack' for both high school students and mature women was developed. Contents included course information, pamphlets on computing careers, an interactive computer based information system on Computing Careers, a visually challenging poster as well as profiles of female computing professionals. During 1994 the pack was distributed to secondary schools and Open Learning sites in Central Queensland. It was intended that evaluation of this pack would commence late in 1994 (Clayton et al 1994).
- A bridging computing course by external study was produced to primarily increase the basic computing skills and confidence of females. This course

was available to students of either gender and incorporated gender inclusive material.

- A market research project was undertaken on students perceptions of the computing industry, barriers to studying computing, sources of information, and key influences in students choice of discipline.

Perceptions of the career that is available on the completion of the course influences the final decision that is made when choosing a tertiary course. If an individual does not have a prior knowledge of the course, then they can not form these perceptions, and therefore, have nothing to be attracted to...

Some students pictured a computing career as just sitting in front of the computer doing data entry all day.
(Dooley 1992, in Clayton, 1993)

Tertiary:

A series of workshops was held targeted at teaching staff to raise awareness amongst the staff of gender imbalance and to brainstorm for ideas to redress the situation.

University of Tasmania

Studies in 1992 revealed that, for every 100 male students entering computing at the University of Tasmania, 56 would graduate. In comparison, for every 100 female students entering, 26 would graduate (Gibson 1993)[1]. At the 1993 Women in Computing Conference Paay, Gibson and Hartnett suggested:

The principal problem appeared to be the lack of natural opportunities for female students to develop support networks and provide themselves with an accepting environment in which to ask questions and explore ideas. (Paay et al p61)

To overcome this isolation a mentor scheme was established in 1993 where first year female students were matched with second or third year students in small groups. Mentors helped orientate the new students sharing with them ways of surviving and learning at University.

One visible sign of the mentor scheme is a strong feeling of group identity among female students studying Applied Computing courses. Their network extends across all years and across all courses. The students themselves have asked for the mentor meetings to continue next semester. Our feeling is they will evolve into network meetings with the mentor-mentee roles barely visible. (Paay et al p63)

The Tasmanian group also trialed a number of approaches to help the female students including hosting of a morning tea during orientation, and a series of posters showing "A Day In The Life Of A Computing Student / Professional". The poster series had been an initiative following the 1992 conference at which Teague and Clarke had argued that many students had inaccurate perceptions of computing careers. They suggested that one way of attracting more girls into computing would be to provide materials which represented a more accurate view of the nature of the work in the computing profession.

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[1] In 1991 the non continuing students at higher education institutions averaged 14.6%, however this proportion of non continuing students is only a crude measure of drop out rates. (DEET 1992)

Curtin University

James (1992) gave a description of a support network established at Curtin University in 1990. This group called Women in Information Systems (WIIS) provides a networking body not only for female students but for females working in the computer industry as well. The group provided an opportunity for the

> *transfer of ideas and experiences, and professional development and updates in current computing activities in both private and public sectors as well as within academia.* (James 1992 p2).

WIIS meet on a monthly basis with each meeting consisting of a formal presentation by a guest speaker as well as time for informal networking. The group has provided women in the computing industry with a networking body and has provided many opportunities for its members that might otherwise not have presented themselves. The meetings have also opened up lines of communication between the University and the computing industry.

University of Ballarat

The Bachelor of Computing degree at the University of Ballarat had a low enrolment by female students and it was found that these students were performing more poorly then their male counterparts in computing subjects (Cartwright and Colville 1994). Although it was recognised that a number of factors contributed to this, one major problem appeared to be the lack of peer support and networking. A mentor scheme was established in 1994 for ALL first year students though participation was not enforced. Mentoring occurred in small groups: five mentees and two mentors. It was decided to involve all students, as previous research had found that the female students did not want a support scheme set up exclusively for the girls and " *it was felt that all students could benefit"* from such a scheme (Cartwright and Colville 1994, p3). One of the activities organised for the groups was a "treasure hunt" during Orientation week. Students had to discover the location of lecture rooms, computer labs and staff offices. Students also met personally all of the academic staff.

Positive outcomes from the scheme to date have included social and work interaction between students from all years in the course. As a consequence of the initial treasure hunt staff were perceived to be more approachable and helpful. On the negative side "*none of the female students believe that they have gained any real benefits from the mentor scheme*" (Cartwright and Colville 1994, p6). Changes are planned for 1995 with the possibility of the creation of a mentor group just for females.

Smith and Kelly (1994) are also investigating the feasibility of introducing programming to students via visual programming in 1995. They argue that the

> *visual approach offers a common reference point for teaching students the correct techniques in programming on an equitable basis. Additionally the new strategy provides an avenue for females to overcome learning difficulties encountered in programming classes.* (Smith and Kelly, p106)

La Trobe University, Bendigo

To encourage more girls to enrol in computing courses the Department of Computing and Information Systems has created a promotional kit (video, brochure

and poster) which has been distributed to approximately 120 secondary schools in the area (Martin and Staehr, 1994). Contact has been established with local secondary schools and university staff have participated in school run career sessions.

During 1994, the success and retention issues of current female students was approached through a pilot program. Commencing students were allocated to tutorial groups so that 50% of each group was female. Senior women students were employed to act as demonstrators for these groups and to increase the staff-student ratio. Fortnightly meetings were held between the students, senior students and program leaders to discuss progress and problems. As yet the evaluation of both initiatives has not been published. A number of administrative problems with the pilot program were documented: such as the difficulty of maintaining contact with students and problems with the academic calendar and the scheduling of group meetings.

Deakin University

The findings of Jones and Clarke (1993) on the effects of a single-sex educational setting on the attitudes and computing experience of girls suggested that girls from single-sex settings have more experience with computers and their attitudes towards them are more positive than for girls from co-educational schools. However when the factor of prior experience was removed from the analysis the type of educational setting was no longer found to be significant.

> *Diversity of computing experience was the strongest predictor of secondary girls' attitudes towards computers. The findings indicate the importance of designing computing curricula for girls which emphasise a broad range of computing activities in preference to focussing on skill development in a single area. (Jones & Clarke,p1)*

Clarke and Teague (1993) produced a video entitled *Girls, have you considered computing?* which attempted to bridge the gap between the reality of working in this field and the perceptions of students. The video was aimed at secondary girls and has been purchased by over 300 Australian secondary schools and there has been an enthusiastic response from the girls who have viewed it. This video was also included in the Computing Careers Information Pack distributed by CQU. Victoria University of Technology undertook a similar project with the assistance of local school girls to produce a promotional video "Real Girls Use Computers".

Victoria University of Technology

In 1993 22% of continuing female students withdrew from the course before the end of the year compared with 12% of male students. Retention rates amongst female students was therefore seen as a major issue confronting the Department of Business Computing especially as the intake of female students was initially only 32%. In 1994, with the assistance of a grant from the Equity and Social Justice Department[2], members of the department established a mentor scheme (MicroNet). The aim was to provide commencing female students with support from older female students; by giving the students the opportunity to speak with, and get help from, other students

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[2] This grant was funded by the Australian Commonwealth Government Department of Employment Education and Training (DEET) under the HEAP scheme-Equity grant and administered by Victoria University of Technology's Department of Equity and Social Justice.

who have been through a similar experience. It was considered that these commencing students would feel less intimidated and therefore more confident in continuing their studies in information technology with this support. Meetings were facilitated through the provision of time and space. Two computers were set aside exclusively for MicroNet girls and equipped with an email facility. This greatly assisted communication between the girls and gave them alternative computing facilities.

The response to the scheme was very positive. Interviews with a number of the girls suggested they want to continue with the scheme; they enjoyed the contact and would like more social activities in the future. One point came out strongly in the interviews, the girls feeling of isolation and the need they had for contact with more women studying computing. At least two of the students said they were planning to drop out but, as a result of MicroNet, they had reconsidered. Interestingly, these two girls were second year students and mentors in the program.

An other activity undertaken by Victoria University of Technology to promote the range of options girls have, in the computing field, is to host an annual "Girls in Computing Day". Girls, aged between 14 and 16 years, from neighbouring secondary schools are invited to spend a day at the University exploring computers. The girls are given hands on experience through a series of different activities, using a range of software. The aim is to present to the girls the many faces of computing and to move their thinking away from seeing computers as word processors or machines just for programming.

University of Southern Queensland

University of Southern Queensland has taken this idea further and has recently conducted a 'Girls into Information Technology' residential camp. This was an extension of a previous initiative 'Girls in Maths and Science Summer School' (Ryan 1994) - a residential camp which is conducted annually by USQ. The four day information technology camp was held at a rural Queensland site to enable outback twelve to fourteen year old girls to gain practical experience, knowledge and confidence in their use of computers. Girls needed to go through a selection process to participate in the camp and they were fully funded to attend. A residential school was chosen to enable participants to come from a wide area. This also enabled more opportunities for the girls to network with other girls with similar interests. Other advantages identified were the fewer distractions and the greater opportunities for group work.

Conclusion

There is little doubt that in the past three years there has been a growing awareness within educational institutions of the need to provide equal access to success in non-traditional areas, including computing. This research and actions undertaken have highlighted the fact that present imbalances exist and need to be redressed. The research has also documented a variety of ideas and strategies which have been implemented.

Much has been achieved since our inaugural Women in Computing meeting in February 1992. The continuing annual conferences have provided the catalyst, with participants sharing ideas on how to tackle the major issues our female students face in

computing. What now do we see as our key challenges for the future? Firstly we need wider acceptance from both within and without our own institutions of women's place in information technology.

For our female students to be successful in commencing and completing, there needs to be greater acceptance and recognition from the wider academic community of the needs of women in these courses. It will come as no surprise that many of our male colleagues do not accept that our female students face difficulties that are different from those of their male counterparts. The males simply do not see that there is a problem. This is certainly hindering progress.

We live in the age of the so called SNAG (Sensitive New Age Guy). Many men appear to understand and repeat the feminist rhetoric, however their behaviour shows no more than superficial support for female colleagues, their attitudes show no fundamental change. Any initiatives undertaken to increase or support female participation in our courses is often seen as exclusive and generally sexist in that it does not include the male students. Establishment of schemes such as the mentor scheme have to be done carefully and to some extent subversively to avoid the ire of others in the department.

Secondly there is a continuing need to encourage more women to see they have a future in computing. We are in a catch 22 situation; because there are so few women undertaking computing courses the support and networks they need to succeed are not there, as a result few women complete. Girls moving into tertiary education do not see computing as a career because so few women are there; we perpetuate the cycle.

The challenges for the Women in Computing group is to further support our female students and to try and change the perspective girls have of computing. The path has not always been easy and there are many hurdles still to overcome but we believe the effort is worthwhile and progress is slowly being made.

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